

4.3 GHz Passive Wireless Sensor System, Phase I

Completed Technology Project (2018 - 2019)



Project Introduction

Thru several NASA SBIR/STTR and DoD contracts, the University of Central Florida's (UCF) Center for Acoustoelectronics Technology (CAAT) group has a developed and demonstrated a complete 915 MHz SAW sensor system, having measured temperature, strain, hydrogen gas, magnetic fields and others. Pegasense and UCF will team and collaborate to further the state-of-the-art in wireless sensor technology effort, provide a handheld wireless sensor system at TRL 3-4 in Phase I and TRL 5-6 in Phase II, and demonstrate sensor interrogation using multiple temperature sensor platforms at 4.3 GHz. It is a significant upgrade of the current UCF 915 MHz wireless software defined radio (SDR) approach, to the newly opened avionics band at 4.3 GHz with a 200 MHz bandwidth. All the experience, approaches, and methodologies gained in the 915 MHz SDR system will provide a path forward. The Phase I prototype system will be at the requested TRL 3-4 level and a demonstration will be provided to NASA. The current UCF 915 MHz system has been fully developed and demonstrated with SAW sensors, however, the SDR system approach will software changes in hardware configuration and post-processing, such that any sensor in the operational band could be successfully interrogated. Therefore, new SAW temperature sensors at 4.3 GHz and other technologies, such as self-resonant antenna, dielectric resonator sensors or others, would demonstrate the SDR approach across multiple sensor technology platforms. To the proposers' knowledge, an SDR 4.3 GHz sensor transceiver system has not been previously demonstrated, 4.3 GHz SAW sensor devices have not ever been demonstrated, and a cross sensor platform approach has not been previously demonstrated. Success in the Phase I and Phase II of the proposed work would be a significant technology leap forward by making a reprogrammable SDR transceiver capable of interrogating multiple sensors, and sensor embodiments and mixed technologies.

Anticipated Benefits

- Wireless measurements on rotating parts
- Wireless passive sensors in wings, fuselage, or other inaccessible points
- Wireless sensor networking and SHM master monitor
- Wireless massively deployed sensors
- Inflatable habitats
- Hydrogen gas sensing in launch vehicles, ground support, and others
- Cryogenic gas and liquid monitoring
- Military and commercial aircraft SHM
- Airplane cabin SHM



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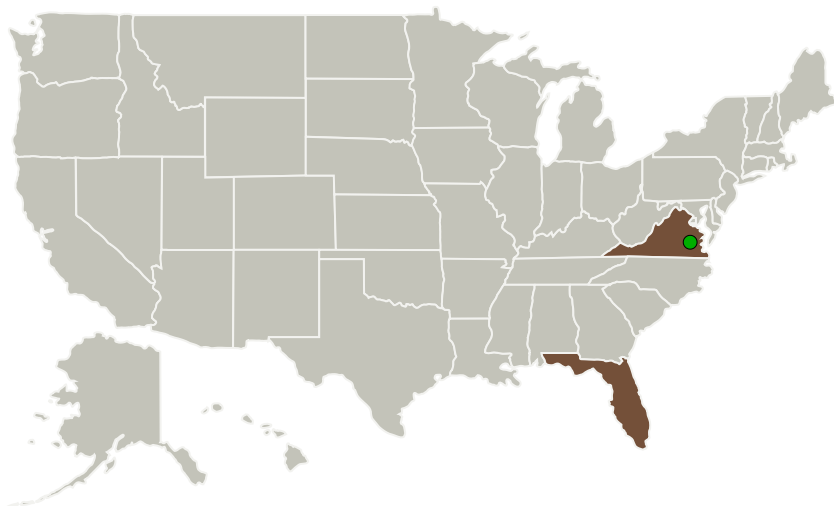
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- Landing gear SHM
- Sensor monitoring of inaccessible areas, within the fuselage or wings of airframes
- Hydrogen, methane, ammonia, humidity, gas and other wireless passive sensors
- Transportation (Bridges, highways, etc.) wireless monitoring
- Engine and turbine monitoring

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Pegasense, LLC	Lead Organization	Industry Women-Owned Small Business (WOSB)	Winter Springs, Florida
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Pegasense, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Donald C Malocha

Co-Investigator:

Donald Malocha

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Primary U.S. Work Locations

Florida

Virginia

Project Transitions

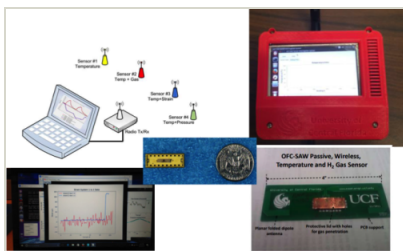
July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

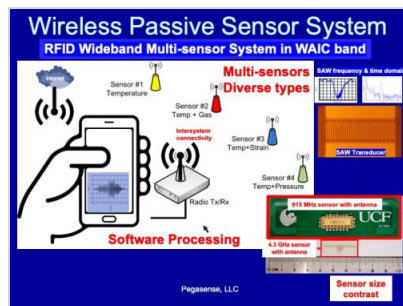
- Final Summary Chart(<https://techport.nasa.gov/file/140873>)

Images



Briefing Chart Image

4.3 GHz Passive Wireless Sensor System, Phase I
(<https://techport.nasa.gov/image/127927>)

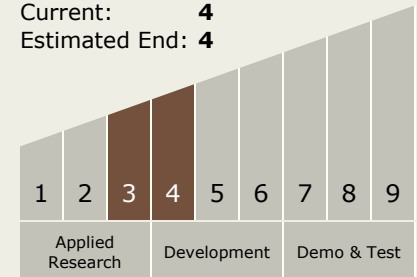


Final Summary Chart Image

4.3 GHz Passive Wireless Sensor System, Phase I
(<https://techport.nasa.gov/image/127698>)

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - TX08.3 In-Situ Instruments and Sensors
 - TX08.3.4 Environment Sensors

Target Destinations

Earth, The Moon, Mars